REMARKS

Summary

This Amendment is responsive to the Office Action mailed on January 29, 2002. Claims 16, 19, and 21 are amended. New claims 22-24 are added. Claims 16-24 are pending.

Applicants note that claim 20 is allowed. New claims 22-24 depend on claims 16, 19 and 21 respectively and specify that the communication path comprises a downstream communication path in a television distribution system having the transmitter at a television headend and the receiver associated with a subscriber terminal (see, e.g., Applicant's specification, page 24, lines 11-17).

Claims 16 and 19 stand rejected under 35 U.S.C. § 102(e) as being anticipated by Pidgeon (US 5,850,305).

Claim 21 stands rejected under 35 U.S.C. § 102(e) as being anticipated by an article by Ju, et al. entitled "Method for Eliminating Narrowband Shortwave Interference in Upstream Channel of HFC", Electronic Letters, April 30, 1998, Vol. 34, No. 9, Pages 852-854 (Hereinafter "Ju").

Claims 17 and 18 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Pidgeon.

Applicants respectfully traverse these rejections in view of the amended claims and the comments which follow.

Discussion of Pidgeon

Pidgeon discloses adaptive predistortion control circuitry for use in a communication system. An optical

source 101 generates an optical carrier 105 which is intensity modulated by an electo-optical modulator 103 in accordance with a radio frequency signal 107. The modulator 103 modulates the optical carrier 105 in response to both the input RF signal and a predistortion signal provided by a predistorter 102 (Col. 4, 1, lines 3-14). The predistorter 102 is provided to compensate for the non-linearities of the modulator 103. The predistorter 102 recieves an RF input representing a television or other signal to be transmitted. In response to the RF input signal the predisorter 102 provides a signal to the modulator 103 including both the RF input and a DC bias. In response, the waveguides vary the amplitude of the optical carrier signal provided by the optical source 101 (Col. 5, lines 3-15). An adaptive predistorion control circuit 104 provides feedback control to the predistorter 102.

Applicants respectfully submit that the Examiner's rejections based on the Pidgeon reference appear to be the result of confusion in the use of the term "predistortion". In Pidgeon, "predistortion" refers to the intentional addition of non-linear distortion such that these non-linear distortions will cancel exiting non-linear distortions in the system. The technique used in Pidgeon is also known as liberalization and is a technique that attempts to actually cancel out the unwanted distortion products by creating equal but opposite distortion products (i.e. first and second error correction signals which eliminate first and second order distortion (Col. 6, lines

37-63)). In Pidgeon, the exact nature of the distortion must be known in order to create the exact opposite distortion.

In Applicants' invention, the distortion is not cancelled, but rather the distortion is filtered at the receiver with a narrow band filter. Contrary to Pidgeon, with the claimed invention, the exact nature of the distortion does not need to be known, only the frequency of the distortion needs to be known. With the present invention, a narrow band filter in the receiver then attenuates the unwanted distortion product. Unfortunately this filter also 'distorts' the desired signal by attenuating some of the desired signal products. In order to counter the effect of this unwanted filtering of the desired signals at the receiver, the claimed invention includes an inverse filter at the transmitter to boost the desired signal products by the same amount as they will be attenuated by the filter in the receiver. This is referred to as "predistortion" in Applicants' specification, but perhaps should more properly be called pre-equalization. In the claimed invention, the pre-distortion cancels the effect of the filter, it does not cancel the distortion itself.

Technically and mathematically, filtering and equalizing used in the claimed invention are linear processes fundamentally different from the non-linear processes of distortion and pre-distortion used in Pidgeon. Pidgeon cancels the distortion directly using pre-

distortion. With the present invention, the distortion is filtered and the effect of the filter at the receiver is cancelled using predistortion or pre-equalization at the transmitter.

Pidgeon does not disclose or remotely suggest a method for filtering nonlinear distortion, whereby distortion caused by a filter at a receiver is compensated for by predistortion at the transmitter as in the claimed invention. In fact, the predistorter 102 of Pidgeon is provided to compensate for the non-linearities of the modulator 103 at the transmitter (Col. 5, lines 3-5). The predistorter 102 is located at the transmitter and is part of a feedback loop for canceling out distortion introduced by the modulator 103 at the tranmitter. In contrast, in the present invention, the filter is located at the receiver and the predistortion is introduced at the transmitter to compensate for distortion effects introduced by the filter at the receiver. In contrast to Pidgeon, no feedback loop is required in the present invention, as the frequency at which the distortion introduced by the filter at the receiver is a known fixed frequency (see, e.g., Applicants' specification, page 26, lines 8-13). Therefore, the signal can be predistorted at the transmitter to accentuate the signal magnitude at this known fixed frequency.

Applicants' system is useful for providing, for example, a distortion free downstream path in a television system from a television headend to a subscriber terminal. For example, the transmitter may be a located at the

television headend and the receiver may be a subscriber's set-top box (Page 24, lines 11-14). In contrast, in Pidgeon, the receiver 110 is part of the predistortion control circuit 104 at the transmitter, and is not equivalent to the receiver of the present invention.

Discussion of Ju

Ju discloses a method for eliminating narrowband shortwave interference in an upstream channel of a hybrid fibre-coax (HFC) network, using a finite impulse response digital filter (FIRDF). With the system disclosed by Ju, the receiver at the headend must first measure the frequency, bandwidth, and power level of the narrow shortwave interference (NSI). If the upstream path includes NSI, the computer designs an FIRDF H(z) with a corresponding stop band (Ju, page 852, Col. 2, lines 35-40). The addition of H(z) in the receiver causes intersymbol interference (ISI). To compensate, the formal inverse of H(z) is used at the transmitter.

The FIRDF system of Ju is implemented in an upstream path of a cable television channel, where the frequency of the distortion is not known. Therefore, the distortion must be measured by the receiver in Ju. In contrast, the invention claimed in Applicants' claim 21 is for use in, for example, a downstream television communication path, where the frequency of the distortion is a known fixed frequency and need not be measured.

In Ju, the receiver is a return path receiver located at a headend, and the transmitter is located at a subscriber's set-top terminal. In contrast, the receiver of the present invention is, for example, the subscriber's set-top terminal and the transmitter is, for example, located at the headend.

Ju does not disclose or remotely suggest Applicants' system for filtering distortion which occurs at a known fixed frequency as set forth in Applicants' claim 21.

Applicants respectfully submit that the present invention is not anticipated by and would not have been obvious to one skilled in the art in view of Pidgeon or Ju, taken alone or in combination with any of the other prior art of record.

Further remarks regarding the asserted relationship between Applicants' claims and the prior art are not deemed necessary, in view of the amended claims and the foregoing discussion. Applicants' silence as to any of the Examiner's comments is not indicative of an acquiescence to the stated grounds of rejection.

Withdrawal of the rejections under 35 U.S.C. § 102(e) and 35 U.S.C. § 103(a) is therefore respectfully requested.

Conclusion

In view of the foregoing, the Examiner is respectfully requested to reconsider this application, allow each of the presently pending claims, and to pass this application on to an early issue. If there are any remaining issues that need to be addressed in order to place this application into condition for allowance, the Examiner is requested to telephone Applicants' undersigned attorney.

Respectfully submitted,

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Date: April 2, 2002

VERSION OF AMENDED CLAIMS WITH MARKINGS TO SHOW CHANGES MADE

16. (Twice Amended) A method for filtering nonlinear distortion in a signal communicated from a transmitter to a receiver via a communication path, comprising the steps of:

pre-distorting said signal at the transmitter to accentuate the signal magnitude at a known fixed frequency where said nonlinear distortion resides;

communicating the pre-distorted signal to said receiver; and

filtering the pre-distorted signal at said receiver to attenuate the signal magnitude at said known fixed frequency, wherein said pre-distorting of said signal at said transmitter compensates for distortion effects caused by said filtering at said receiver.

19. (Twice Amended) Apparatus for filtering nonlinear distortion in a signal communicated from a transmitter to a receiver via a communication path, comprising:

a first filter at the transmitter to provide a pre-distorted signal having an accentuated magnitude at a known fixed frequency where said nonlinear distortion resides; and

a second filter at the receiver adapted to filter the pre-distorted signal to attenuate the signal magnitude at said known fixed frequency, wherein said first filter

compensates for distortion effects caused by said second filter.

21. (Amended) Apparatus for filtering nonlinear distortion in a signal communicated from a transmitter to a receiver via a communication path, comprising:

a first notch filter at the transmitter having a first transfer function to provide a pre-distorted signal having an accentuated magnitude at a known fixed frequency where said nonlinear distortion resides; and

a second notch filter at the receiver having a second transfer function adapted to filter the pre-distorted signal to attenuate the signal magnitude at said known fixed frequency;

wherein said first transfer function is the inverse of said second transfer function.

Insert the following new claims 22-24:

--. 22. (NEW) A method in accordance with claim 16, wherein:

said communication path comprises a downstream communication path in a television distribution system;

said transmitter is located at a television headend;

said receiver is associated with a subscriber terminal.

23. (NEW) An apparatus in accordance with claim 19, wherein:

said communication path comprises a downstream communication path in a television distribution system;

said transmitter is located at a television headend;

said receiver is associated with a subscriber terminal.

24. (NEW) Apparatus in accordance with claim 21, wherein:

said communication path comprises a downstream communication path in a television distribution system;

said transmitter is located at a television headend;

said receiver is associated with a subscriber terminal.--